Frequently Asked Questions on the Alberta Tier 1 and Tier 2 Soil and Groundwater Remediation Guidelines

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Preface

In June 2007, Alberta Environment introduced the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV 2007a)*, and the *Alberta Tier 2 Soil and Groundwater Remediation Guidelines (AENV 2007b)* at workshops in Edmonton and Calgary, Alberta. Workshop participants provided questions to the presenters to answer verbally during the sessions. For the benefit of the workshop attendees and others who are interested in the workshop material, these questions and answers have been drafted into the document *Frequently Asked Questions on the Alberta Tier 1 and Tier 2 Soil and Groundwater Remediation Guidelines*. Other frequently asked questions on the proposed remediation certificate program have been included to provide readers with a broader scope of information.

Why do consultants need liability insurance? Is this a requirement of Alberta Environment?

The Remediation and Reclamation Sign Off Advisory Committee recommended that a professional member who is signing off on remediation or reclamation work carry professional liability (errors or omissions) insurance unless they are undertaking work on behalf of their employers.

The committee included representatives from the:

- Alberta Institute of Agrologists;
- Alberta Society of Professional Biologists;
- Association of Engineering and Science Technology Professionals of Alberta;
- Association of the Chemical Profession of Alberta;
- Association of Professional Engineers, Geologists and Geophysicists of Alberta;
- College of Alberta Professional Foresters, and;
- College of Alberta Professional Forest Technologists.

Can guidelines be mixed and matched?

No. The remediation values contained in the *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities* (AENV 2001) or the *Alberta Tier 1 or Tier 2 Soil and Groundwater Remediation Guidelines* (AENV 2007) must be used separately. A proponent cannot choose the best values from each document and apply them to their site.

For further information refer to AENV 2007a, Section 1.3.

Why are some guideline values more stringent for fine soil than coarse soil for petroleum hydrocarbons?

In some instances, the surface soil remediation guideline for a particular substance is lower for fine soil than for coarse soil. This will occur when the Protection of Human Health, Domestic Use Aquifer is the governing pathway. In Section 5, Appendix C of the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*, you will find a description of the dilution factors for the groundwater pathway. Dilution Factor 3 is used to estimate the dilution of the contaminant as it infiltrates downward from the contaminated zone, in the soil into the aquifer in question. In the default case, coarse soil will have a higher hydraulic conductivity and a higher Darcy Velocity than for fine soil. Therefore, there will be greater mixing and a higher dilution factor for coarse soil than for fine soil. This results in a lower fine soil value for this pathway than for coarse soil.

How do I use Tables 1 and 2 to determine the appropriate guideline for a Contaminant of Concern? How do I use the tables in Appendix A and B to select the guidelines for specific pathways and receptors?

At Tier 1, Tables 1 and 2 provide values based on the limiting pathways and receptors for each land use in question. There are no options to modify these tables at Tier 1.

In some cases, you may consider investigating whether the limiting pathway and receptor applies at Tier 2. This is explained in the Tier 2 guideline. For instance, for benzene, the Alberta Tier 1 guideline for fine soil is 0.046 mg/kg based on the protection of the domestic use aquifer. If you can demonstrate that the aquifer does not fit the definition of a domestic use aquifer, and that there is an adequate separation between the contaminated aquifer and one that may be considered a domestic use aquifer, then based on Table A-3, Appendix A, the next limiting pathway for fine soil is 1.6 mg/kg based on the vapour inhalation pathway. Therefore, the benzene criteria for a fine soil residential site in this case would become 1.6 mg/kg.

For further information refer to AENV 2007a: Tables, Appendix A, and Appendix B.

How do the Management Limits for Petroleum Hydrocarbons work?

In the case of petroleum hydrocarbons (PHC) only, management limits have been obtained from the CCME Canada Wide Standard for Petroleum Hydrocarbons. Where a Tier 2 approach is used, it is not possible to modify the management limit for PHC. Therefore, where the guideline modification results in a value greater than the management limit, the PHC management limit is adopted as the remediation guideline. Where any other pathway or receptor is lower than this value, the value for the limiting pathway/receptor must be used in setting the remediation guideline.

For further information refer to AENV 2007a: Section 2.3.4; AENV 2007b: Appendix B.

Does the Tier 1 Guideline apply when there are no surface water receptors near the site?

The pathway for Protection of Freshwater Aquatic Life is explained in the Tier 2 guideline. At Tier 1, there is no option to remove the Protection of Freshwater Aquatic Life pathway. At Tier 2, you may remove this pathway only if there is no surface water receptor within 300 m of the closest edge of the plume, the

contaminant is an organic contaminant and has significant rates of degradation during transport. If a stagnant water body, as defined in the guidelines, is present within 300 m of the closest edge of the plume, a Tier 2 approach is required.

It may be possible to remove the aquatic life pathway for contaminant plumes that are a minimum of 100 m up gradient of the surface water body, but this requires a detailed groundwater monitoring program to demonstrate the direction of groundwater flow at the location in question.

For further information refer to AENV 2007a: Section 5.1.2, Section 5.1.6; and, AENV 2007b: Part A, Section 4.1; Part B, Section 3.2; Appendix C, C.7.

How do you define a source area that is changing in size?

If a source area is growing with time, then source control has not been achieved and Tier 1 or Tier 2 assessment is not possible. You must ensure that all sources are completely controlled or remediated prior to assessment of any residual contaminant. If the source area may be decreasing over time, then the source area is based on the size at the time of assessment.

For further information refer to AENV 2007a: Section 2.3.1.

Does the ecological contact pathway include nutrient and energy cycling?

Nutrient and energy cycling are included in the protocol used to develop the Tier 1 guidelines. Guidelines are calculated for this pathway if there is sufficient data to do so. Nutrient and energy cycling guidelines are evaluated independently from the ecological contact pathway and are provided in a separate column in Tables A1 to A10.

For further information refer to AENV 2007a: Section 4.3; Appendix C, Section 4.2; and, AENV 2007b: Part A, Section 3.4.2; Part B, Section 3.2.

Can a hydrometer be used to determine soil grain size?

Sieve analysis using a 200-mesh screen is preferred for determining median grain size. The hydrometer method is not recommended because the short settling time for particles >75 µm is likely to introduce measurement errors.

Alberta Environment conducted a workshop on the analytical method for the Canada-Wide Standard (CWS) for Petroleum Hydrocarbons in Soil in 2001. Attendees included representatives from analytical laboratories, consulting

companies, and regulatory agencies. Workshop attendees discussed a number of issues related to the CWS analytical methodology and recommended that Canadian Society of Soil Science (CSSS) methods be used to measure median grain size. CSSS-recommended methods are contained in Carter (1993). Chapter 47 covers methods for particle size distribution, including sieve analysis and hydrometer techniques. When using the sieve technique, a 200-mesh sieve must be used in place of the 300-mesh sieve identified in Carter (1993). This is because the Tier 1 definition of coarse soil is based on a 75 µm particle size, rather than Carter's (1993) 50 µm value (the Canadian System of Soil Classification uses 50 µm to separate sand from silt while the Unified Soil Classification Systems uses 75 µm. The Tier 1 definition is based on the Unified System). When using the hydrometer method in Carter (1993), a reading at 40 seconds is required for 50 µm particles, so an even shorter settling time leading to additional uncertainty would likely be needed for the larger 75 µm particles. The ASTM hydrometer method (ASTM D 422-63), developed for the Unified Soil Classification System, avoids this problem by requiring a separate sieving step after the hydrometer test to measure particles >75 µm.

References:

Alberta Environment. 2003. PHC CWS Analytical Methods Workshop 2001: Participants Report. Report No. SSB/LM/02-4. Available on-line at: http://environment.gov.ab.ca/info/library/6808.pdf

ASTM D422-63(2002)e1. Standard Test Method for Particle-Size Analysis of Soils.

Carter, M.R. (ed.) 1993. Soil Sampling and Methods of Analysis. Lewis Publishers.

Should the Tier 1 guidelines be used for trace element contaminants in organic soils?

Tier 1 guidelines cannot be used for trace elements in organic soils if the Tier 1 guideline value is based on eco-contact. Mineral soils are used in the eco-toxicity studies from which Tier 1 guidelines have been developed. The chemical form and binding mechanisms of inorganic substances is likely to be different in organic soils than mineral soils and ecological receptors may be different than those used for the development of Tier 1 guidelines. This means that the bioavailability and toxicity of trace elements in organic soils is likely different than in mineral soils, and the ability of mineral soil-based guidelines to protect ecological receptors in organic soils is too uncertain for the application of Tier 1 Guidelines. The CCME (2006) protocol provides guidance for developing eco-contact guidelines that can be applied at Tier 2.

Reference:

CCME. 2006. A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. Canadian Council of Ministers of the Environment. PN 1332. Available on-line at: http://www.ccme.ca/assets/pdf/sg_protocol_1332_e.pdf

How do you demonstrate a barrier layer?

The Domestic Use Aquifer (DUA) pathway can be excluded if there is at least a 5.0 m barrier layer (meeting the prescribed characteristics) between the contaminated zone and the DUA. The barrier may be either an unconsolidated or consolidated layer. The preferred process for demonstrating that a 5.0 m barrier layer exists is an actual measurement of the thickness and hydraulic conductivity of this layer.

The site investigation plan should include one or more boreholes drilled at least 5.0 m deeper than the contaminant plume. It is more cost-effective to include the deeper borehole(s) in the initial drilling plan than to return to the site to drill additional boreholes. Each borehole should be completed as a groundwater monitoring well with the appropriate screened interval designed to obtain the in-situ K-value. Unless it is necessary to drill though the contaminant plume, the deeper borehole(s) should be drilled off-set from the plume to minimize the potential for vertical contaminant migration.

The drilling program must provide the lithologic description necessary to support the professional's judgment that this barrier layer is consistent, or is expected to be consistent, vertically and laterally beneath the contaminant plume. The in-situ K-value must meet the prescribed requirement.

There may be reasons why a direct measurement and analysis of the barrier layer underlying the contaminant plume is not possible. Professional judgment will have to be used to provide indirect evidence to support the argument that a barrier layer exists. Additional information is provided in response to the next question.

For further information refer to AENV 2007b: Appendix E, Section E.2.

Can driller's water well logs be considered evidence for a barrier layer?

Driller's well logs recorded during installation of a water well were not designed for the same purpose as for contaminated site assessment. Driller's logs are useful lines of evidence that will help in gathering appropriate information from the site and support site specific observations on lithological features. They are not sufficient on their own to exclude a DUA.

The presence of a water well driller's report means that a DUA exists locally; however, the absence of a water well driller's report is not sufficient evidence to claim that a potential DUA does not exist.

The information on water-well drillers' reports varies in detail and quality. The professional will be expected to exercise discretion in the selection of appropriate reports to support the technical argument. There should be sufficient number of referenced wells to demonstrate that the local geology is consistent beneath the site. The referenced wells should be within two kilometres of the site.

The water-well drillers' reports may be used to support arguments such as:

- depth of probable DUA;
- identification of the barrier layer (unconsolidated or consolidated); and
- consistency of geology (DUA and barrier layer) beneath the site.

Can I exclude the DUA if there is a local by-law that prohibits using the DUA for potable water?"

Some communities and many municipalities have by-laws that prohibit the installation of water wells. This is considered an administrative control under the Exposure Control option. While it is possible to exclude the potential impact to the DUA in such circumstances, this does not meet the regulatory requirements of other Tier 2 options. It is up to the proponent to ensure the municipal activities and by-laws are consistent with the administrative controls under the Exposure Control option, and the municipality is consulted as a third party on the use of their by-law under the exposure control option.

For Tier 2 modification, must the parameters be measured together?

The parameters that may be modified at Tier 2 are referenced in the Tier 2 guideline. In general, before proceeding to a Tier 2 guideline modification, you should conduct a sensitivity analysis of the parameters used in the model and assess all parameters that may have a significant influence on the Tier 2 guideline. In some instances, it may be difficult to measure the parameter in question, and, therefore, it is possible to use a default parameter rather than moving to a Tier 2 assessment. For instance, soil moisture is often a difficult parameter to assess due to the potential for spatial and temporal variation, therefore, it is often advisable to employ default parameters regardless of the sensitivity analysis.

For further information refer to AENV 2007b: Appendix C, C.3; Table C-2.

Why does the Tier 2 guideline state I must use the most conservative value for guideline adjustment? How can I deal with outliers to the data set?

When you collect the minimum number of samples to make any adjustment, you do not have sufficient information to determine whether the distribution is parametric or follows a normal distribution, or what value within a range of values is most critical for determining potential risk of exposure. Therefore, the only option available at this stage in the screening level is to choose the most conservative estimate from a limited pool of information.

Can sites that were assessed under the 2001 PHC guidelines still be remediated to those guidelines?

The *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* have replaced the *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Sites* (2001) and the *Risk Management Guidelines for Petroleum Storage Tank Sites* (2001). The Tier 1 guidelines together with the *Alberta Tier 2 Soil and Groundwater Remediation Guidelines and Exposure Control*, form the management options recognized under Alberta's contaminated sites management framework. Proponents who remediate their sites to 2001 guidelines will not receive closure from Alberta Environment, with the exception of specified land remediated prior to December 1, 2007, as discussed in the next question. Remedial measures must be taken at all sites with actual or potential adverse effects in accordance with Part 5 of the *Environmental Protection and Enhancement Act*.

Which guidelines should be used in the transition period for upstream oil and gas sites?

There is a transition period for upstream oil and gas sites to use the Tier 1 and 2 guidelines. If the lab analytical data sheets are dated on or before December 1, 2007, and indicate compliance with the *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities* (2001), the 2001 guidelines can be used to show compliance for a reclamation certificate. The application for a reclamation certificate can be made at any time. Alternatively, the Tier 1 and 2 guidelines can be used during the transition period. However, after December 1, 2007, the Tier 1 and 2 guidelines must be used.

See Alberta Facts At Your Fingertips, July 2007, R&R/07-01.

Do we have to use Tier 1 and 2 guidelines after December 1, 2007 at upstream oil and gas sites?

There is a transition period for upstream oil and gas sites to use the Tier 1 and 2 guidelines. If the lab analytical data sheets indicate compliance with the *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities* and they are dated on or before December 1, 2007, they can be used for a reclamation certificate. Alternatively, the Tier 1 and 2 guidelines can be used during the transition period. However, after December 1, 2007, the Tier 1 and 2 guidelines must be used.

If a flare pit was remediated in 2001, can the *Alberta Soil and Water Quality Guidelines for Hydrocarbons at Upstream Oil and Gas Facilities* be used until December 1, 2007?

If the petroleum hydrocarbons at a site were remediated to meet the 2001 guidelines, and the lab analytical data sheets are dated on or before December 1, 2007, additional remediation to meet the PHC values in the Tier 1 or 2 guidelines is not required. An application for a reclamation certificate can be submitted at any time

Are remediation certificates going to be voluntary or mandatory?

When they become available, remediation certificates will be voluntary.

APPENDIX A

List of Acronyms

AENV	Alberta Environment
ASTM	American Society for Testing and Materials
CCME	Canadian Council of Ministers of the Environment
CSSS	Canadian Society of Soil Science
DUA	Domestic Use Aquifer
K-value	hydraulic conductivity value
µm	micron or micrometer
m	metre
mg/kg	milligrams per kilogram
PHC	Petroleum Hydrocarbons
PHC CWS	Canada-Wide Standards for Petroleum Hydrocarbons in Soil